Space Weather Technical Forecast

Issued on Friday, 13 May 2022 at 01:26 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: R1-R2 radio blackouts likely. Chance (30%) of G1 / Minor geomagnetic storm on day (16th).

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Moderate with an M1.4 flare at 12/2020 UTC, which consisted of a long period flare from the northeast limb and a CME is apparent in coronagraph imagery. This is likely to be non-Earth directed, but further analysis will be done for confirmation. No other Earth CMEs were observed in the available satellite imagery during the period.
There are currently four numbered sunspot regions on the visible disc. AR3007, in southeast quadrant, remains the largest and most complex region, exhibiting a Beta-Gamma formation and a delta spot. AR3006, in the southwest, is also noteworthy being a Beta-Gamma region, however it has seen some decay during the past 24 hours with penumbra fading in its trailing spots. AR3008 and AR3009 are fairly small and simple Beta regions. Two new and unnumbered regions appeared on the disc over the last 24 hours. A beta region developed northwest of AR3007 and an alpha region rotated round the southeast limb.

Solar Wind / Geomagnetic Activity: The solar wind speed as measured by DSCOVR at L1 has been slow, generally between 300 and 350 km/s. The density was above average, with a peak of 35 ppcc at 12/1323 UTC, it has since declined, falling to average levels (5-10 ppcc) from 12/1850 UTC. The total interplanetary magnetic field strength has been weak or moderate between 4 and 11 nT. The Bz fluctuated between positive and negative values, in the range -7/+9 nT. The Phi angle was mostly negative (towards the Sun) until 12/1325 UTC when it switched to a predominantly positive (away from the Sun) orientation, indicating a sector boundary crossing. Geomagnetic activity was Quiet to Unsettled (Kp 1-3).

Energetic Particles / Solar Radiation: The high energy proton flux (10 MeV) has been at moderate levels for much of the period, in response to the M2.6 flare at 11/1859 UTC, peaking at 5.45e0 ppcc at 12/0405 UTC. It has subsequently decreased, dropping to background levels from 12/2300 UTC. The high energy electron flux (greater than 2 MeV) has remained at background levels, with the corresponding electron fluence well below the Active (1e8 integrated pfu) threshold, with a slight decreasing trend. 1.1e6 integrated pfu observed at 13/0000 UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is likely to remain Moderate (R1/R2) levels, with a slight chance of Strong (R3) X class flares.

Solar Wind / Geomagnetic Activity: No significant enhancements are likely in the solar wind in the next 3 days, however on day 4 (16th) winds are expected to become elevated due to the arrival of the fast winds emanating from CH81/+. Predominantly Quiet geomagnetic activity is expected to become Unsettled to Active on day 4 (16th), with a chance of a G1 / Minor Storm.

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) is

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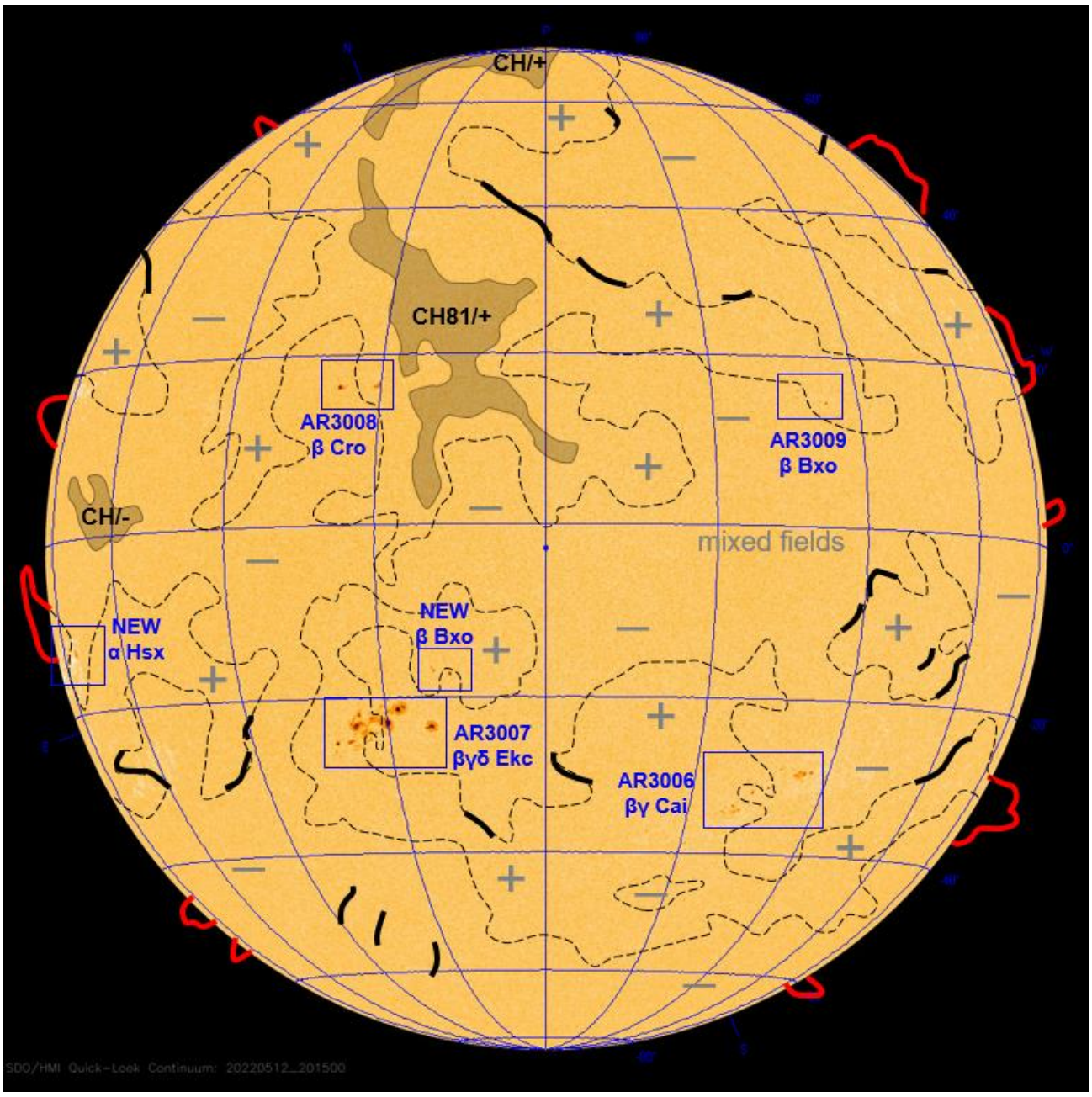
expected to be at background levels during the forecast, although there is slight risk of an S1-S2 event due to the presence of AR3007. The high energy electron flux (greater than 2 MeV) is forecast to remain at normal background levels through much of the forecast period, with the 24-hour electron fluence staying below Active (1e8 integrated pfu) threshold.

Figure 1. Solar Analysis Valid 12/2000 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

An X1.5 flare on 10 May from south-centre disc appears to have produced an asymmetric CME, combining with a long-period flare from the eastern limb. Coronagraph analysis remains inconclusive and although there is a chance of seeing a transient feature at L1 later on the 13th May, this remains unlikely, with no significant portion of this CME complex heading for Earth.
Otherwise, solar winds are expected to remain at ambient levels through days 1-3 (13th-15th). On day 4 (16th), solar winds are expected to become elevated, as CH81/+ moves into a geoeffective position. Geomagnetic activity is expected to be predominantly Quiet during days 1-3 (13th-15th), with just isolated Unsettled intervals, in the absence of any CME influence. Activity becoming Unsettled to Active on day 4 (16th), with a chance of a G1 / Minor Storm, due to the arrival of the CIR and HSS associated with CH81/+.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	5	1	1	30
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Nil.

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Radio Blackouts - X-Ray Flares:

Solar activity was Moderate over the past 24 hours. This level of activity is likely to continue, with further isolated M-class flares likely over the coming days and a slight chance of an X-class flare. Currently the most likely source for this activity is AR3007 (Ekc / Beta-Gamma-Delta). However, there are various bright regions visible on STEREO-A EUVI 195 imagery, which will be rotating onto the visible disc over the coming days and are likely to enhance the flare risk. One particularly bright region, just round the northeast limb, was responsible for the M1.4 flare at 12/2020 UTC.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	Yes	60	70	70	70
Very Active	R3 to R5 X Class	No	10	15	15	15

Figure 2: GOES-16 X-ray flux.

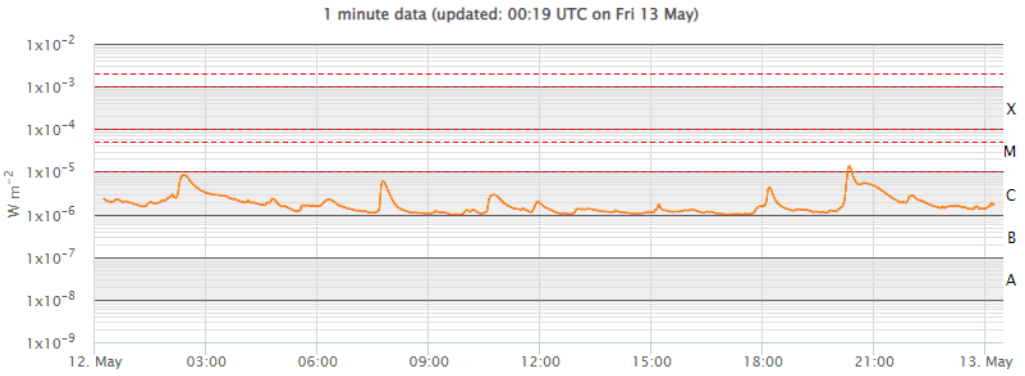
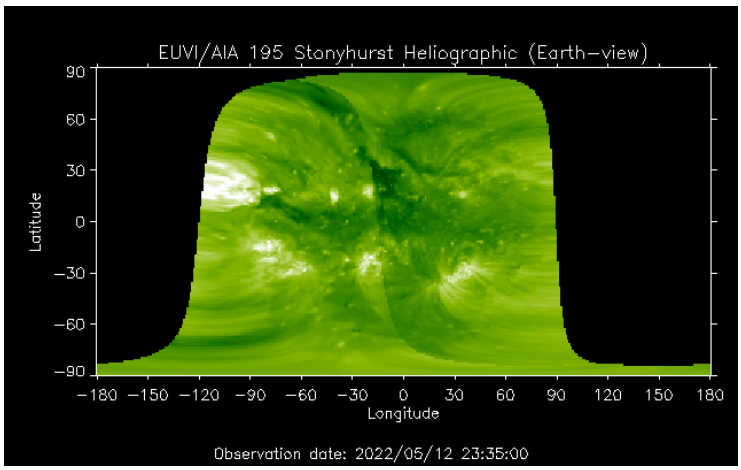


Figure 3: EUVI/AIA 195 A Stonyhurst Heliographic



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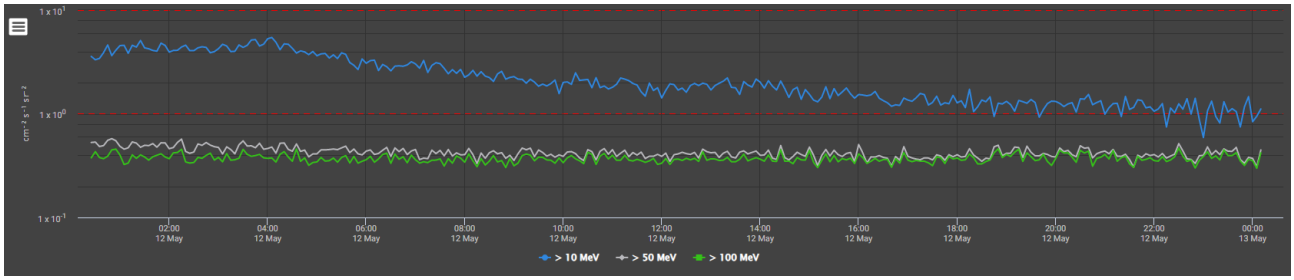
Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) is close to background levels and is generally expected to remain at that level throughout the period. However, there is a slight chance of an S1-S2 event during the forecast period, primarily due to AR3007 which will continue its transit across the visible disc and into the western hemisphere over the coming days.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	10	10	10	10
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

Figure 4: GOES-16 Proton flux.



High Energy Electrons Event (≥ 2MeV):

High energy electron flux (greater than 2 MeV) is expected to be at background levels through much of the forecast period, but may begin to rise towards the end of day 4 (16th) due to the arrival of the high speed stream from CH81/+. The corresponding electron fluence is therefore expected to remain below the Active (1e8 integrated pfu) threshold during the forecast period.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	1	1	5
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

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